The Space Congress® Proceedings

2004 (41st) Space Congress Proceedings

Apr 28th, 8:00 AM

Panel Session IV - Launch Vehicle Options for Exploration

Daniel J. Collins

Vice President and Delta Program Manager, The Boeing Company

Launch Vehicle Options for Exploration

Dan Collins
Vice President
Delta Programs

April 28, 2004

04HB04001_1

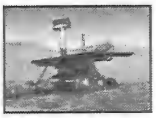
Delta 2003 Mission Successes

Delta Top Launcher in 2003

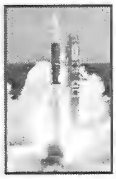
Launcher	Success	Failure
Delta	9	0
Soyuz	8	0
Atlas	6	0
Long March	6	0
Proton	5	0
Ariane	4	0
Titan	4	0
Pegasus	4	0
Cosmos 3M	3	0
Sea Launch	3	0
H-2A/M-5	3	1
GSLV/PSLV	2	0
Molniya M	2	0
Rockot	2	0
Strela	1	0

NASA's Workhorse

Mars Missions

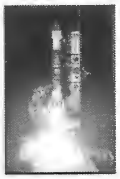


Spirit



6/10/03

Opportunity



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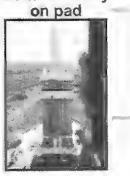
100% NASA Mission Success

Delta IV Heavy on pad



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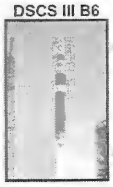

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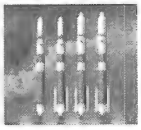
Substantial Delta Investments are Available to Jump Start NASA's Exploration Vision

Delta IV Heavy

Heavy configuration to satisfy USG heavy-lift requirements

Rocketdyne RS-68

First new U.S. booster engine in over 20 yrs per USG requirements



Delta IV Rocket Development

Decatur, AL

1.5m sq. ft. state-of-the-art manufacturing facility and tooling

SLC 37 at CCAFS

New launch pad and infrastructure

Boeing Has Invested Billions in Design Development and Infrastructure

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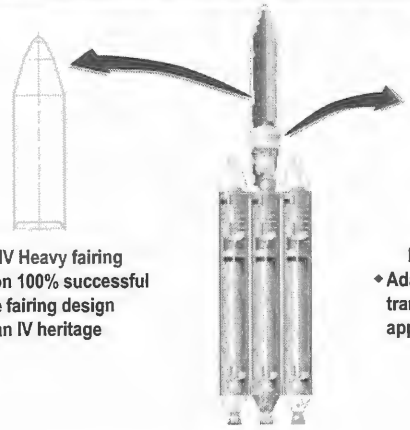
Delta IV Heavy Subsystems May Also be Used for Other Exploration Launch Options



Delta IV Heavy fairing
- Based on 100% successful heritage fairing design
- Titan IV heritage

Delta IV upper stage
- Adaptable for in-space transportation/upper stage applications

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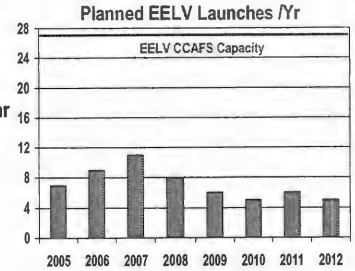
Delta IV – Affordable & Sustainable Exploration Support

- Robust capabilities minimizes near-term investment
- Decatur Manufacturing Facility
  - Designed to produce 40 CBCs/year
- RS-68 developed and flight-proven
  - Production capability sized to support Delta-IV production
- SLC 37-B designed for 15 launches per year

Planned EELV Launches /Yr



Delta IV Support Of EELV And Other NASA/Civil Programs Assures Launch And Manufacturing Proficiency

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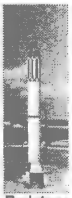
We've Been Down This Path Before . . .

- Apollo/Saturn programs built upon incremental steps to achieve an extraordinary objective
- Saturn program built upon the solid achievements of much smaller precursor launch systems

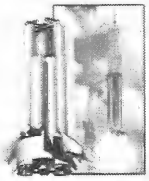
Saturn Launch Vehicle Evolutionary Development



Redstone

Jupiter

Saturn I



Saturn IB

Saturn V

Spiral Development From Existing Systems Enabled Saturn V

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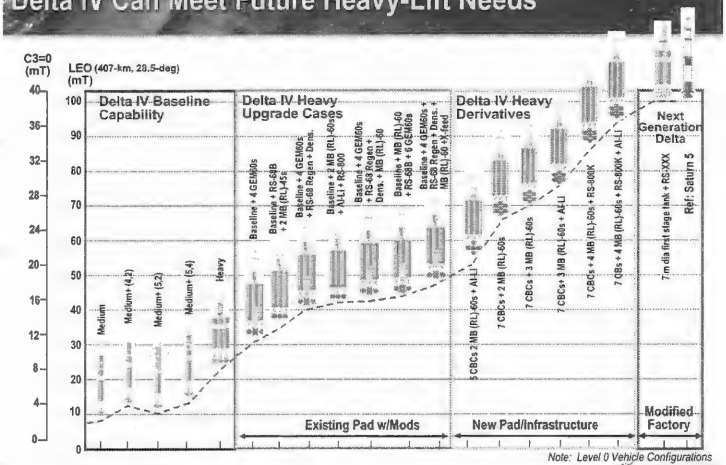
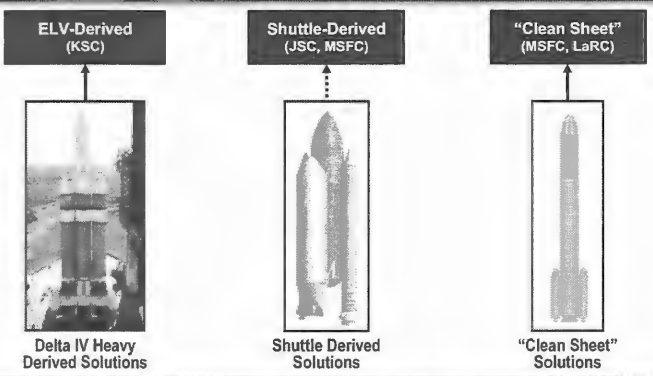
Delta IV Can Meet Future Heavy-Lift Needs



Note: Level 0 Vehicle Configurations

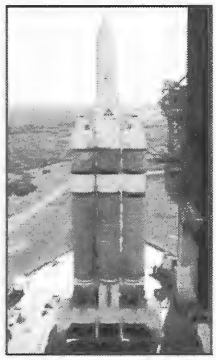
Boeing is Supporting NASA Trade Studies



Boeing Space Exploration Systems Provides Integrated Perspective

Delta IV Provides Near-Term Benefits for Exploration

- Flight-proven Delta IV provides significant near-term capability
- Delta IV provides a low cost mechanism to jump-start exploration
  - Candidate low-risk upgrades identified may enable up to 45-mT to LEO
  - NASA Exploration and USAF EELV program synergy
- Delta IV upgrades also can support alternate development solutions for super heavy-lift capability

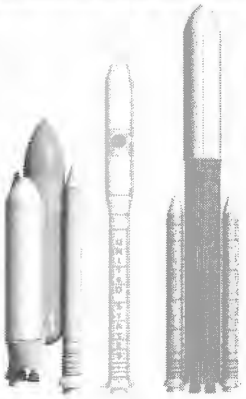


1st Delta IV Heavy Launch Summer 2004

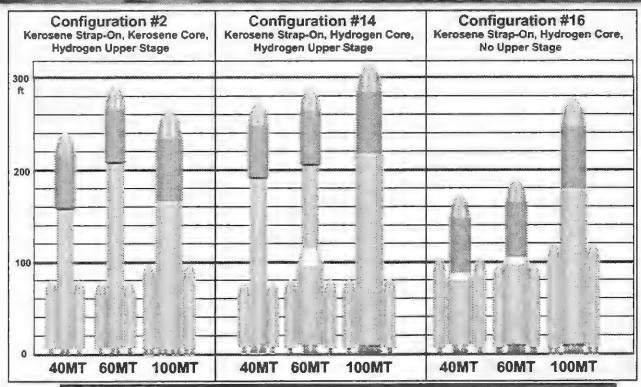
Shuttle-Derived Vehicle Heavy-Lift Options

- Flight-proven Shuttle system could enable significant exploration capability
- Boeing is part of a collaborative Industry Study Team
- Shuttle-Derived Vehicle may provide a low development cost option for ~100-mT to LEO
  - SDV would greatly simplify operations and reduce costs
- Shuttle-Derived Vehicle supports spiral development of super heavy-lift capability

Focused On Providing Shuttle-Derived Options, Not Recommending A Preferred Configuration



NGLT Funding Constrained "Clean Sheet" Study

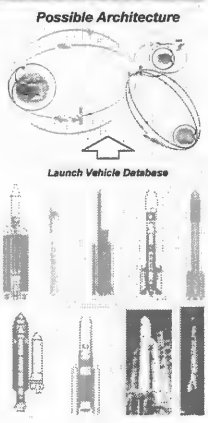


Boeing Phantom Works Assessing New LOX/Kerosene Vehicle Options Constrained to Existing Engines, Vehicle Tooling Size, etc, With a $7B Non-Recurring Development Cost

Boeing Launch Vehicle Exploration Architecture Study

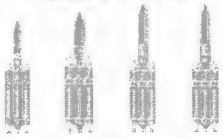
- Launch Vehicles critically impact Exploration architecture development process
  - Drives destination sizing, cycle time and tonnage
  - Defines largest in-space transportation element
- Developed single Boeing Launch Vehicle database
- LV Database Trade Parameters
  - Life Cycle Cost
  - Performance
  - Spiral development
  - Ground infrastructure capabilities/constraints

Boeing Will Provide NASA With Our Best Independent Launch Vehicle Assessment

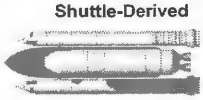


Space Transportation Options for Space Exploration

Delta IV Growth



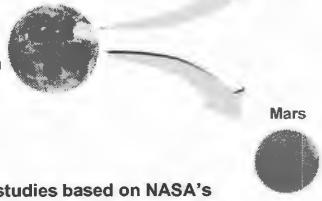
Shuttle-Derived



"Clean Sheet"

Existing/growth Delta IV, Shuttle-Derived or "Clean Sheet" options could provide substantial Exploration capability

"Best" Solution ?



Detailed trade studies based on NASA's exploration requirements, funding and other considerations will be needed to identify the best solution

BOEING

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